US009313200B2

(12) **United States Patent**
Hoyos

(10) **Patent No.: US 9,313,200 B2**
(45) **Date of Patent: *Apr. 12, 2016**

(54) **SYSTEM AND METHOD FOR DETERMINING LIVENESS**

(71) Applicant: **Hoyos Labs Corp.**, San Juan, PR (US)

(72) Inventor: **Hector Hoyos**, New York, NY (US)

(73) Assignee: **HOYOS LABS IP, LTD.**, Oxford (GB)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **14/201,462**

(22) Filed: **Mar. 7, 2014**

(65) **Prior Publication Data**

US 2014/0337948 A1 Nov. 13, 2014

Related U.S. Application Data

(60) Provisional application No. 61/822,746, filed on May 31, 2013, provisional application No. 61/842,800, filed on Jul. 3, 2013, provisional application No. 61/842,739, filed on Jul. 3, 2013, provisional

(Continued)

(51) **Int. Cl.**
G06F 21/32 (2013.01)
H04L 29/06 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***H04L 63/0861*** (2013.01); ***G06Q 20/3276*** (2013.01); ***G06Q 20/40145*** (2013.01); ***G07F 19/20*** (2013.01); *G06F 21/32* (2013.01)

(58) **Field of Classification Search**
CPC G06Q 20/3276; G06Q 20/40145; G07F 19/20; H04L 63/0861; G06F 21/32
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,480,615 B1 * 11/2002 Sun et al. 382/103
6,792,159 B1 * 9/2004 Aufrichtig H04N 5/367 348/E5.081

(Continued)

FOREIGN PATENT DOCUMENTS

WO WO 2013147763 A1 * 10/2013

OTHER PUBLICATIONS

Elmongui, "Spatio-Temporal Histograms," Department of Computer Science, Purdue University, West Lafayette, IN, USA, Springer-Verlag Berlin Heidelberg, 2005, pp. 19-36.*

(Continued)

Primary Examiner — Jung Kim
Assistant Examiner — James J Wilcox
(74) *Attorney, Agent, or Firm* — Leason Ellis LLP

(57) **ABSTRACT**

Systems and methods are provided for recording a user's biometric features and generating an identifier representative of the user's biometric features and whether the user is alive ("liveness") using mobile devices such as a smartphone. The systems and methods described herein enable a series of operations whereby a user using a mobile device can capture imagery of a user's face, eyes and periocular region. The mobile device is also configured analyze the imagery to identify and determine the position of low-level features spatially within the images and the changes in position of the low level features dynamically throughout the images. Using the spatial and dynamic information the mobile device is further configured to determine whether the user is alive and/or generate a biometric identifier characterizing the user's biometric features which can be used to authenticate the user by determining liveness and/or verify the user's identity.

13 Claims, 8 Drawing Sheets